




CERTIFICATE OF TRANSLATION

I, Chiori Ueda, c/o IIDA PATENT BUREAU,
11-26, Marunouchi 2-chome, Naka-ku, Nagoya-shi, Aichi-ken, Japan, hereby
certify that to the best of my knowledge and belief the attached English
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Japanese Patent Application No. 2002-375059 -- made by me.

This 6th day of July, 2005


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[Name of the Document] Specification
[Title of the Invention] Occupant Protection Device
[Claims]
[Claim 1]

An occupant protection device comprising a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, and a container box located above the knee-protecting airbag device for housing goods,

the knee-protecting airbag device comprising an airbag inflatable for protecting the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover for covering an opening of the case, the airbag cover being attached to the case and openable upon inflation of the airbag,

the container box comprising a box body opened rearward and a lid for openably covering an opening of the box body, wherein:

the box body and the airbag cover are formed of a single-piece molded part of synthetic resin.

[Claim 2]

The occupant protection device according to claim 1, wherein:

the case comprises a circumferential wall portion arranged along the circumference of the opening of the case for covering the folded airbag;

the circumferential wall portion comprises a retainer protruded outward for attachment to the airbag cover;

the airbag cover comprises: a door openable when pushed by the inflating airbag; a thinned breakable portion located in a periphery

of the door and breakable when pushed by the inflating airbag to help open the door; a hinge line located in the periphery of the door, and bent upon opening of the door; and a joint wall portion attached to the circumferential wall portion of the case by having the retainer inserted therein and thus being held by the retainer; and

the molded part integrating the box body and the airbag cover is a two-color molded part of a soft material and a hard material compatible to each other, and at least the doors, the hinge line, and the joint wall portion of the airbag cover are soft sections made from the soft material, and remaining regions are hard sections made from the hard material.

[Claim 3]

The occupant protection device according to claim 1 or claim 2, wherein:

the lid is supported by a pivot section formed in the case of the knee-protecting airbag device in a swingable manner such that the lid opens and closes the opening of the box body.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a vehicle occupant protection device located in front of a front passenger's seat for protecting knees of an occupant seated in the front passenger's seat.

[0002]

[Description of Related Art]

In the prior art, the patent publication 1, for example, shows a device for protecting knees of a vehicle occupant seated in a front passenger's seat which device includes an inflatable airbag for

protecting occupant's knees.

[0003]

[Patent Publication 1]

JP 8-80797 A

[0004]

[Problems to be solved by the invention]

However, there is conventionally disposed a container box (or glove box) for housing a map and so on in front of the front passenger's seat.

[0005]

If it is desired that the knee-protecting airbag device and the container box are both located in front of the front passenger's seat, increased number of components have to be mounted on the vehicle, which would complicate the mounting work on the vehicle.

[0006]

The present invention contemplates to solve the above problem, and therefore, has an object to provide an occupant protection device which does not increase the number of components and improves the mounting work even if a container box and a knee-protecting airbag device for protecting knees of an occupant seated in a front passenger's seat are both mounted in front of the front passenger's seat.

[0007]

The occupant protection device of the present invention includes a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, and a container box located above the knee-protecting airbag device for housing goods. The knee-protecting airbag device includes an airbag inflatable for protecting

the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover for covering an opening of the case, the airbag cover being attached to the case and openable upon inflation of the airbag. The container box includes a box body opened rearward and a lid for openably covering an opening of the box body. The box body and the airbag cover are formed of a single-piece molded part of synthetic resin.

[0008]

In the occupant protection device of the present invention, the box body of the container box and the airbag cover are formed of a single piece molded part of synthetic resin. In other words, two parts are formed into a single-piece component. Therefore, the number of components to be mounted on the vehicle is reduced.

[0009]

The airbag cover is attached to the case for covering the opening of the case in an openable manner upon inflation of the airbag. Moreover, the case itself is so made of rigid sheet metal as to allow the inflating airbag to protrude from the opening smoothly, and is tightly secured to the vehicle body. Consequently, the airbag cover is tightly secured to the body by means of the case, and since the box body is integral with the airbag cover, less fixing means is required to fix the box body to the vehicle body compared with a case of mounting the airbag cover and the box body separately. To paraphrase, if the airbag cover and the box body are formed into a single-piece component, a fixing structure of the box body to the vehicle body is simplified in comparison with the case where the airbag cover and the box body are separate entities, thereby reducing working processes in mounting the box body on the body.

[0010]

Therefore, the occupant protection device of the present invention contributes to reduce the number of components, reduce fixing means of the box body to the vehicle body, and improve the mounting work even if a container box and a knee-protecting airbag device for protecting knees of an occupant seated in a front passenger's seat are both mounted in front of the front passenger's seat.

[0011]

Furthermore, in the occupant protection device of the present invention, since the airbag cover and the box body of the container box disposed above the airbag cover are integral, it is prevented that the case and so on of the knee-protecting airbag device are seen by the occupant in an opening/closing operation of the lid. More specifically, when the airbag cover and the box body are separate entities, a gap may arise between them. In that case, the case and so on of the knee-protecting airbag device are likely to be seen from the gap between the airbag cover and the box body in such a time as opening/closing of the lid. In the occupant protection device of the present invention, however, since the airbag cover and the box body are molded into a continuous single-piece component, there arises no gap between the box body and the airbag cover, so that the case and so on of the knee-protecting airbag device are prevented from being seen by the occupant.

[0012]

In the occupant protection device of the present invention, it is desired that:

the case includes a circumferential wall portion arranged along the circumference of the opening of the case for covering the folded airbag;

the circumferential wall portion has a retainer protruded outward for attachment to the airbag cover;

the airbag cover includes: a door openable when pushed by the inflating airbag; a thinned breakable portion located in a periphery of the door and breakable when pushed by the inflating airbag to help open the door; a hinge line located in the periphery of the door, and bent upon opening of the door; and a joint wall portion attached to the circumferential wall portion of the case by having the retainer inserted therein and thus being held by the retainer; and that

the molded part integrating the box body and the airbag cover is a two-color molded part of a soft material and a hard material compatible to each other, and at least the doors, the hinge line, and the joint wall portion of the airbag cover are soft sections made from the soft material, whereas remaining regions are hard sections made from the hard material.

[0013]

With this construction, when the door of the airbag cover is pushed by the inflating airbag and opens while breaking the breakable portion disposed therearound, the door does not break although it may be pushed and deformed, but is elastically deformed and smoothly opens since it is of the soft section. Moreover, the hinge line also bends easily. Consequently, the door opens smoothly and allows the airbag to deploy smoothly. Besides, since the joint wall, which serves to attach the airbag cover to the circumferential wall portion of the case, is also the soft section, the wall is elastically deformed and prevents a periphery of a retaining hole holding the retainer of the circumferential wall portion from breaking if subjected to a strong tensile force when the door opens. Of course, since the remaining region of the two-color

part is the rigid hard section, it is capable of keeping a predetermined shape easily.

[0014]

The lid may be supported by a pivot section formed in the case of the knee-protecting airbag device in a swingable manner such that the lid opens and closes the opening of the box body.

[0015]

With this construction, since the case is rigid and secured to the vehicle body tightly so the inflating airbag protrudes from the opening smoothly, the lid supported by the pivot section formed in the case opens and closes in a stable manner.

[Means of Solving the Problem]

[0016]

[Mode for Carrying out the Invention]

An embodiment of the present invention will be described with reference to drawings. As shown in Figs. 1 to 3, an occupant protection device S embodying the present invention includes a knee-protecting airbag device 11 and a container box 60. The knee-protecting airbag device 11 is located in front of an occupant M seated in a front passenger's seat for protecting knees K (KL and KR) of the occupant M in the event of a collision of a vehicle. The container box 60 is located above the knee-protecting airbag device 11 for containing goods.

[0017]

Front, rear, left and right in this specification are based on a condition where the occupant protection device is mounted on a vehicle, and are consistent with front, rear, left and right of the vehicle.

[0018]

In the occupant protection device S, the knee-protecting airbag

device 11 and the container box 60 are preliminarily assembled together to form an integral mounting module 10. The occupant protection device S is mounted on the vehicle by attaching the module 10 to vehicle body 1.

[0019]

Located in front of the front passenger's seat is an instrument panel 6 as an interior decoration member. Below the instrument panel 6 (as will be called dashboard below), a lid 73 of the container box 60 is arranged in such a manner as to continue from a back surface of the dashboard 6. An airbag cover 44 of the knee-protecting airbag device 11 is arranged below the lid 73 continuously from a back surface of the lid 73.

[0020]

In the foregoing embodiment, there is located an airbag device 80 for a front passenger's seat above the dashboard 6 for protecting a breast and so on of an upper body of the occupant M in the event of a frontal collision of vehicle. The airbag device 80 for a front passenger's seat includes an inflatable airbag 81 for protecting a breast and so on of the upper body of the occupant M, an inflator 82 for feeding the airbag 81 with inflation gas, an airbag cover 83 covering the folded airbag 81 in such a manner as to allow the airbag 81 to deploy upon airbag inflation, and a case 84 for containing the folded airbag 81 and the inflator 82 and holding the airbag cover 83. The airbag cover 83 is so disposed as to close an opening 6a of the dashboard 6. The airbag device 80 is bolt 85 fixed to a bracket 2a formed in a dashboard reinforcement 2. The bolt 85 is fastened with a nut 2b fixed to the bracket 2a.

[0021]

Referring to Figs. 3 to 6, the knee-protecting airbag device 11 in the occupant protection device S according to the embodiment includes a folded airbag 39, an inflator 31 for feeding the airbag 39 with inflation gas, a case 12 opened rearward for containing the folded airbag 39 and the inflator 31, and an airbag cover 44 for covering the vehicle's rear side of the case 12. The airbag cover 44 is a two-color molded part 56 into which a box body 61 of a container box 60 is integrally molded.

[0022]

As referred to Figs. 5 and 6, the inflator 31 is a cylinder-type arranged so that its axial direction may be along the vehicle's left-right direction. The inflator 31 includes a substantially columnar body 32 and a diffuser 33. The body 32 includes a substantially columnar general portion 32a and a small diameter portion 32b projected from an end face of the general portion 32a. There are formed a plurality of gas discharge ports 32c on the outer circumference of the small diameter portion 32b. A connector 36 to which a lead wire 37 is connected for inputting actuating signals is connected to the other end face of the general portion 32a away from the small diameter portion 32b. The diffuser 33 has a substantially cylindrical shape for covering the inflator body 32. The diffuser 33 is provided at the rear side as mounted on the vehicle with a plurality of gas outlet ports 33a for emitting inflation gas. The diffuser 33 further includes a plurality (two, in the foregoing embodiment) of bolts 33d protruded forward of the vehicle, and a plurality of clamping portions 33c for holding the body 32. To attach the inflator body 32 to the diffuser 33, the body 32 is inserted into the diffuser 33 through an insert hole 33b, from the small diameter portion 32b. Then each of the clamping portions 33c is plastically deformed and pressed onto the outer circumference of the general portion 32a. Thus the body

32 is secured to the diffuser 33. If each of the bolts 33d is inserted into a through hole 17a of bottom wall 17 of the case 12, and then nut 34 is fastened with the bolt 33d, the inflator 31 is secured to the case 12.

[0023]

The inflator 31 is actuated by an actuating signal inputted through the lead wire 37 when an airbag actuating circuit mounted on the vehicle detects a frontal collision of the vehicle. When the actuating circuit detects a frontal collision of the vehicle, the inflator 82 of the airbag device 80 for a front passenger's seat also receives an actuating signal simultaneously.

[0024]

The airbag 39 is formed of flexible woven fabric of polyester, polyamide or the like, and takes a substantially rectangular plate shape as deployed completely, as indicated by double-dotted lines in Figs. 1 to 3. The airbag 39 is transversely wide enough to protect both knees KL and KR of the occupant M. The airbag 39 is configured to locate its occupant's side wall 40 toward the occupant M, and locate its vehicle body side wall 41 toward the container box 60 when completely deployed. The wall portions 40 and 41 have substantially the same shapes. The airbag 39 is provided in a portion 42 in the vehicle body side wall 41 or at its lower end region as completely deployed with insert holes 42a and an insert hole 42b, as shown in Fig. 6. The insert holes 42a are for inserting through the individual bolts 33 of the inflator 31, and the insert hole 42b is for inserting through the body 32 of the inflator 31. The airbag 39 is attached to the case 12 with the body 32 of the inflator 31 protruded from the insert hole 42b, and with the periphery of the individual insert holes 42a clamped by the diffuser

33 and the bottom wall 17 of the case 12. In other words, the airbag 39 is secured to the bottom wall 17 of the case 12 by the periphery of the insert holes 42a serving as a mounting portion 42.

[0025]

Referring to Figs. 4, 5, 6 and 10, the case 12 is made of sheet metal and includes a box-shaped body 13 and a panel portion 18 extending outward from a rear end of the body 13. The body 13 includes a circumferential wall portion 14 having a substantially square cylindrical shape, a bottom wall 17 closing vehicle's front side of the circumferential wall portion 14, and an opening 13a opened in substantially rectangular shape at the vehicle's rear side. The circumferential wall portion 14 is provided on the outer surfaces of its walls 14a and 14b confronting each other in the vertical direction with a plurality of retainers 15 (15U and 15D) for attaching upper and lower joint walls 47 and 48 of the airbag cover 44 to the case 12.

[0026]

Referring to Fig. 10, each of the retainers 15U located on the outer surface of the upper wall 14a is formed into a hook shape having substantially Z-shaped section, and is adapted to be inserted into the retaining hole 47a formed on the upper joint wall 47 of the airbag cover 44 and retained thereat. The hooks 15U are located in a plurality of positions (four positions, in the foregoing embodiment) along the transverse direction of the vehicle on the wall 14a.

[0027]

Each of the retainers 15D located on the outer surface of the lower wall 14b is formed into a projection shape having a substantially U-shaped section, and is adapted to be inserted into the retaining hole 48a of lower joint wall 48 of the airbag cover 44. The projections

15D are located in a plurality of positions (four positions, in the foregoing embodiment, refer to Fig. 10) along the transverse direction of the vehicle on the wall 14b. A locking member 16 is inserted into the projections 15D for preventing the projections 15D from coming off from the retaining holes 48a. The locking member 16 includes four bars 16a to be inserted in between the outer surface of the lower joint wall 48 and inner circumferences of the individual projections 15D. The four bars are integrated at the vehicle's front side and secured to the case 12. The locking member 16 is secured to the bottom wall 17 of the case 12 together with the inflator 31 when the inflator 31 is fixed to the case 12 by means of bolt 33d and nut 34.

[0028]

As shown in Fig. 6, the side wall 14c in the circumferential wall portion 14 has an insert hole 14d for inserting through the end of the body 32 of the inflator 31. In the bottom wall 17, there are formed two insert holes 17a for inserting through the bolts 33d of the inflator 31.

[0029]

The panel portion 18 has a substantially flat plate shape elongated in the transverse direction to encircle the opening 13a of the case 12. Here, the case 12 shown in Fig. 10 is constructed by welding two members of a box member 12a and a panel member 12b. The panel member 12b constitutes the panel portion 18, and includes the retainers 15U and 15D to be located on the outer surface of the circumferential wall portion 14 of the body 13. The case 12 is formed of two members of the box member 12a and the panel member 12b so as to reduce kinds of components by that the knee protecting airbag device for a front passenger's seat and a knee protecting airbag device for a driver's

seat use the same kind of components. That is, the box member 12a of the case 12 and the inflator 31 are also used for the knee-protecting airbag device for a driver's seat, whereas the panel member 12b and the airbag cover 44 (or the molded part 56) are so configured as to fit in their arrangement positions.

[0030]

The case 12 includes a support section 20 formed in an upper edge region of the panel portion 18, and a support section 21 fixed to a front side of the bottom wall 17 of the body 13. The support sections 20 and 21 are adapted to abut against a lower surface 64a of a lower wall 64 in a box body 61 of the container box 60, and support the lower wall 64 of the box body 61. The support section 20 supports a substantially entire area of a rear end part of the lower surface 64a of the lower wall 64 except the left and right ends, and the support section 21 supports a substantially entire area of a front end part of the lower wall lower surface 64a except the left and right ends. The support section 20 is formed by extending a transversely central part of the upper edge of the panel portion 18 upward, and the support section 21 is composed of a bracket 22 of sheet metal having a vertically inverted-J shaped section as taken along the front-rear direction of the vehicle and welded to the bottom wall 17.

[0031]

As referred to Figs. 4, 8 and 10, the case 12 includes three joint sections 26 for securing the airbag device 11 to the vehicle body 1. The joint sections 26 are located in positions away from the body 13 in the panel portion 18, and includes joint sections 26A and 26B located in the vicinities of left and right upper edge, respectively, and a joint section 26C located toward right side in the lower edge. Each

of the joint sections has a joint hole 26a for inserting a bolt 27 thereinto. The joint sections 26 are bolt 27 fixed to brackets 3 extending from a center brace or a side member of the vehicle body 1, thereby serving to secure the airbag device 11 to the vehicle body 1. Each of the brackets 3 in advance has a nut 3a fixed thereto for screwing the bolt 27 thereinto.

[0032]

As shown in Figs. 9 and 10, the panel portion 18 of the case 12 in the embodiment is further provided at two positions with pivot sections 28 for supporting a lid 73 of the container box 60 such that the lid 73 may pivotally rotate thereupon when opened and closed. Each of the pivot sections 28 supports each of hinge arms 74 located in left and right sides of the lower edge of the lid 73 in a swingable manner by means of a pin 29.

[0033]

Moreover, as referred to Figs. 4 and 10, the panel portion 18 of the case 12 is provided at four positions in the upper periphery of the opening 13a with apertures 18a for inserting the upper joint wall 47 of the airbag cover 44, and at two positions near left and right edges with apertures 18b for retaining retaining legs 46 of the airbag cover 44. Third apertures 18c shown in Figs. 4 and 10 are adapted to retain not-shown retaining legs of an undercover 4. Slits 18d shown in Figs. 4 and 6 are for inserting left and right side walls 49 of the airbag cover 44 therethrough.

[0034]

The airbag cover 44 is joined to and supported by the case 12 for covering the vehicle's rear side of the folded airbag 39 and the case 12. The airbag cover 44 is formed of the two-shot molded part 56 integrating the box body 61 of the container box 60. The vicinity

of two doors 52 (52U and 52D) covering the opening 13a of the case 12 at the rear side of the vehicle is a soft section 57, whereas a remaining region including a general section 45 located at the left and right sides of the soft section 57, and the box body 61, is a hard section 58.

[0035]

In the embodiment, the soft section 57 of the two-color part 56 is made from thermo-plastic elastomer of olefin whereas the hard section 58 is made from hard polypropylene which is compatible to the soft section 57 and has a shape-retaining property.

[0036]

The two upper and lower doors 52 (52U and 52D) are formed in a substantially rectangular plate shape, and are provided therearound with a thinned breakable portion 51 of a substantially H-shape as viewed from the vehicle's rear side, as shown in Fig. 1. The breakable portion 51 is so provided at its vehicle's front side face with continuous or intermittent grooves as to easily break when the doors 52U and 52D are pushed by inflating airbag 39. Thus the doors 52U and 52D are configured to open upward and downward about integral hinges or hinge lines 53 which are arranged in positions connecting upper ends and lower ends of left and right vertical lines of an H-shape of the breakable portion 51 if the breakable portion 51 breaks when pushed by inflating airbag 39.

[0037]

In the soft section 57 in the periphery of the doors 52U and 52D, there are formed four walls 47, 48, 49 and 49 protruded forward of the vehicle to neighbor the circumferential wall portion 14 of the case 12 in the out side, as shown in Figs. 5, 6 and 10. The upper joint

wall 47 located above the case circumferential wall 14 and the lower joint wall 48 located below the wall 14 serve to join the airbag cover 44 to the case 12. The walls 47 and 48 include retaining holes 47a and 48a, respectively, such that the retainers 15 (15U and 15D) of the circumferential wall portion 14 are inserted and retained thereat. The retaining holes 47a and 48a each has a rectangular shape.

[0038]

The general section 45 is adapted to cover the panel portion 18 of the case 12 at the rear side of vehicle, and includes retaining legs 46 at left and right sides in the lower edge. The retaining legs 46 are protruded forward of the vehicle to be inserted into the apertures 18b of the panel portion 18 and retained by the panel portion 18, as shown in Figs. 9 and 10.

[0039]

The container box 60 includes a box body 61 opened rearward of the vehicle, and an openable lid 73 for covering an opening 61a of the box body 61.

[0040]

As shown in Figs. 3, 4, 7, 10 and 11, the box body 61 includes a bottom wall 66 positioned at the vehicle's front side and apart from the opening 61a, a circumferential wall portion 62 extending rearward of the vehicle from the bottom wall 66 periphery in a substantially square cylindrical shape, and a flange 69 extending up, left and rightwards from the periphery of the opening 61a of the circumferential wall portion 62. The circumferential wall portion 62 includes an upper wall 63 positioned in an upper side, a lower wall 64 positioned in a lower side, and left and right side walls 65 joining the upper and lower walls 63 and 64.

[0041]

In the molded part 57 in which the box body 61 and the airbag cover 44 are integrated, a lower edge region of the flange 69 and a rear edge of the lower wall 64 are continuous with an upper edge region of the airbag cover 44.

[0042]

As shown in Fig. 8, the lower wall 64 of the box body 61 is provided with a detachable cap 64b through which bolts 27 and fixtures used in the bolt 27 fixing of the joint sections 26A and 26B of the case 12 to the bracket 3 of the vehicle body 1 are inserted. As shown in Figs. 9 to 11, the flange 69 is provided in its left and right regions in the lower edge with through holes 69a for inserting the left and right hinge arms 74 of the lid 73. In the upper edge of the flange 69, as shown in Figs. 3, 4 and 11, there is protruded upward a joint piece 70 to be joined to a lower edge 7a of the body 7 of the dashboard 6. The joint piece 70 includes joint holes 70a for inserting bolts 72 to be screwed into the body 7, and retaining legs 70b to be retained by the body 7.

[0043]

As referred to Figs. 9 and 10, the lid 73 is provided at its left and right lower edge in the vehicle's front side face with hinge arms 74 projected forward of the vehicle. The hinge arms 74 are inserted through the through holes 69a of the flange 69 in the box body 61 and joined with the pivot sections 28 of the case 12 in a swingable manner, such that the upper edge 73a of the lid 73 rotates in front-rear direction. The hinge arms 74 include a not-shown damper mechanism such that opening/closing action of the lid 73 may not be performed too rapidly. The lid 73 is position-restricted by abutting against the flange 69

of the box body 61 when closed, and when opened, it is position-restricted by the damper mechanism.

[0044]

Assembly of the knee-protecting airbag device 11 is now described. Firstly, the inflator 31 preliminarily assembled by the body 32 and the diffuser 33 is put in the airbag 39 so that the bolts 33d are protruded from the insert holes 42a and the end of the inflator body 32 is protruded from the insert hole 42b, and then the airbag 39 is folded up. Subsequently, the airbag 39 is wrapped around by a not-shown breakable wrapping film for keeping the folded-up shape. At this time, the bolts 33d and the end of the body 32 of the inflator 31 protruded from the insert holes 42a and 42b are taken out from the wrapping film. Here, other than a resin sheet member, a cloth member such as the woven fabric used to form the airbag 39, a tape member or a string member may be employed as the wrapping film.

[0045]

Thereafter, the inflator 31 is housed in the case 12 together with the folded airbag 39, so that the individual bolts 33d of the inflator 31 are protruded from the insert holes 17a, and the end of the inflator body 32 is protruded from the insert hole 14d. By further fastening not-shown spring nuts with the individual bolts 33d from the front side of the bottom wall 17, the inflator 31 and the airbag 39 are housed in and attached to the case 12.

[0046]

Then the airbag cover 44 integral with the box body 61 as part of the two-color molded part 56 is assembled with the case 12. More specifically, the walls 47, 48 and 49 of the airbag cover 44 are located around the case circumferential wall portion 14 in regions toward the

opening 13a. At this time, as shown in Figs. 12A and 12B, the individual retaining hooks 15U are so inserted into the retaining holes 47a of the upper joint wall 47 as to be retained at peripheries of the retaining holes 47a on an upper surface of the upper joint wall 47. On the other hand, the individual retaining projections 15D are inserted into the retaining holes 48a of the lower joint wall 48, and the retaining legs 46 are so inserted into the apertures 18b as to be retained at the apertures 18b peripheries. Then as shown in Fig. 12C, the bars 16a of the locking member 16 are inserted between the outer surface of the lower joint wall 48 and the inner circumferences of the individual projections 15D, the individual bolts 33d of the inflator 31 are inserted through the locking member 16, and the nuts 34 are fastened with the bolts 33d. Thus the airbag cover 44 integral with the box body 61 is coupled to the case 12, and the knee-protecting airbag device 11 is assembled. Here, a connector 36 having the lead wire 37 connected thereto is preliminarily joined with the body 32 of the inflator 31. When the knee-protecting airbag device 11 is completed, the support sections 20 and 21 of the case 12 abut against and support the lower surface 64a of the lower wall 64 of the box body 61.

[0047]

Subsequently, in order to assemble the container box 60, the holes 74a in the individual hinge arms 74 of the lid 73 are located at the pivot sections 28 of the case 12 through the through holes 69a of the box body 61, and the pins 29 are inserted into the holes 74a and pivot sections 28, so that the lid 73 is assembled with the box body 61 so as to open and close the opening 61a of the box body 61. Thus the container box 60 is assembled, and the module 10 is formed. At this time, the not-shown damper mechanism is mounted on the module 10, too.

[0048]

In the occupant protection device S according to the foregoing embodiment, the main body 7 of the dashboard 6 and the airbag device 80 for a front passenger's seat have been preliminarily mounted on the vehicle before the module 10 is mounted on the vehicle. To mount the module 10 on the vehicle, the individual joint sections 26A, 26B and 26C in the case 12 of the airbag device 11 are firstly located at predetermined brackets 3 of the vehicle body 1, and the joint piece 70 of the container box 60 is applied to the lower edge 7a of the dashboard body 7. At this time, the retaining legs 70b of the joint piece 70 are inserted into predetermined positions of the dashboard lower edge 7a and retained thereat.

[0049]

Subsequently, the individual bolts 27 are fastened into the nuts 3a via the individual joint holes 26a. The fixing of the bolts 27 in the joint sections 26A and 26B is done with the lid 73 and the cap 64b opened. After fixing the bolts 27, the cap 64b is relocated and then the lid 73 is closed. In the joint section 26C, the bolt 27 is easily fixed since an under cover 4 has not yet been mounted at this point.

[0050]

By then fastening the bolts 72 to the lower edge 7a of the dashboard body 7 via the joint holes 70a of the joint piece 70, attaching a decoration cover 8 to the body 7, and by mounting the under cover 4, the mounting of the module 10 on the vehicle is completed. The terminal of the lead wire 37 is connected to the airbag actuating circuit.

[0051]

After mounting the module 10 on the vehicle, when an actuating signal is input to the body 32 of the inflator 31 via the lead wire

37, inflation gas is discharged from the gas discharge ports 32c of the inflator 31, and flows into the airbag 39 via the gas outlet ports 33a of the diffuser 33. Then the airbag 39 inflates and breaks the wrapping film, pushes the doors 52U and 52D of the airbag cover 44, and breaks the breakable portion 51 to open the door 52U upward and 52D downward, respectively about the hinge lines 53. As indicated by double-dotted lines in Figs. 1 and 2, the airbag 39 then protrudes rearward from the opening 54 provided by the opening of the doors 52U and 52D, and further protrudes upward along the rear surface of the lid 73 while expanding and inflating. Accordingly, even if the occupant M seated in the front passenger's seat advances, the inflated airbag 39 is capable of protecting the knees K properly. At this time, since the airbag device 80 for front passenger's seat is actuated, too, the airbag 81 protrudes from the dashboard 6 to protect the upper body of the occupant M, as indicated by double-dotted lines in Fig. 2.

[0052]

In the occupant protection device S of the embodiment, the box body 61 of the container box 60 and the airbag cover 44 are formed of a single molded part 56 of synthetic resin. In other words, two parts are formed into a single-piece component. Therefore, the number of components to be mounted on the vehicle is reduced.

[0053]

The airbag cover 44 is attached to the case 12 for covering the opening 13a of the case 12 in an openable manner upon inflation of the airbag 39. Moreover, the case 12 itself is so made of rigid sheet metal as to allow the inflating airbag 39 to protrude from the opening 13a smoothly, and is tightly secured to the vehicle body 1. Consequently, the airbag cover 44 is tightly secured to the body 1 by means of the

case 12, and since the box body 61 is integral with the airbag cover 44, less fixing means is required to fix the box body 61 to the vehicle body 1 compared with a case of mounting the airbag cover 44 and the box body 61 separately. To paraphrase, if the airbag cover 44 and the box body 61 are formed into a single-piece component, a fixing structure of the box body 61 to the vehicle body 1 is simplified in comparison with the case where the airbag cover 44 and the box body 61 are separate entities, thereby reducing working processes in mounting the box body 61 on the body 1. In the foregoing embodiment, the box body 61 is not directly joined to the vehicle body 1 but merely bolt 72 fixed to a part 7 of the dashboard 6 so that good appearance may be kept in a parting line with the dashboard 6. Thus the fixing structure of the box body 61 to the body 1 is as simplified as possible. Here, the box body 61 may be joined to the dashboard 6 only by the retaining legs 70b or the like and bolt-fixing may be omitted, on condition that the parting line of the box body 61 and the dashboard 6 looks good.

[0054]

Therefore, although the container box 60 and the knee-protecting airbag device 11 for protecting the knees K of the occupant M seated in a front passenger's seat are both mounted in front of the front passenger's seat, the occupant protection device S of the embodiment conduces to reduce the number of components, and the number of fixing means of the box body 61 to the vehicle body 1, thereby improves mounting workability.

[0055]

Furthermore, in the occupant protection device S of the embodiment, since the airbag cover 44 and the box body 61 of the container box 60 disposed above the airbag cover 44 are integral, it is prevented that

the case 12 and so on of the knee-protecting airbag device 11 are seen by the occupant M in an opening/closing operation of the lid 73. More specifically, when the airbag cover 44 and the box body 61 are separate entities, a gap may arise between them. In that case, the case 12 and so on of the knee-protecting airbag device 11 are likely to be seen from the gap between the airbag cover 44 and the box body 61 in such a time as opening/closing of the lid 73. In the occupant protection device S of the embodiment, however, since the rear edge region of the lower wall 64 and the lower edge region of the flange 69 of the box body 61 are continuous with the upper edge region of the airbag cover 44, there arises no gap between the box body 61 and the airbag cover 44, so that the case 12 and so on of the knee-protecting airbag device 11 are prevented from being seen by the occupant M.

[0056]

In the occupant protection device S of the embodiment, the case 12 includes a circumferential wall portion 14 disposed along the circumference of the opening 13a for covering the folded airbag 39, and the circumferential wall portion 14 includes retainers 15 (15U and 15D) protruded outward for joinder with the airbag cover 44. The airbag cover 44 includes: the doors 52U and 52D openable when pushed by the inflating airbag 39; the thinned breakable portion 51 breakable when pushed by the inflating airbag 39 for allowing the doors 52U and 52D to open; the hinge lines 53 disposed around the doors 52U and 52D to be bent upon opening of the doors 52U and 52D; and the joint walls 47 and 48 attached to the circumferential wall portion 14 of the case 12 by having the retainers 15 (15U and 15D) inserted therein and being held by the retainers 15 (15U and 15D).

[0057]

Moreover, the molded part 56 integrating the box body 61 and the airbag cover 44 is a two-color molded part of soft material and hard material compatible to each other. The doors 52, the hinge lines 53, the breakable portion 51, and the joint walls 47 and 48 of the airbag cover 44 is included in the soft section 57 made from the soft material, whereas remaining regions are included in the hard section 58 made from hard material.

[0058]

In such molded part as 56, when the doors 52 of the airbag cover 44 are pushed by the inflating airbag 39 and open while breaking the breakable portion 51 disposed therearound, the doors 52 do not break although they may be pushed and deformed, but are elastically deformed and smoothly open since they are of the soft section 57. Moreover, the hinge lines 53 also bend easily, since they are of the soft section 57. Consequently, the doors 52 open smoothly and allow the airbag 39 to deploy smoothly. Besides, since the joint walls 47 and 48, by which the airbag cover 44 is attached to the circumferential wall portion 14 of the case 12, are also the soft section 57, the walls 47 and 48 are elastically deformed and prevent peripheries of the retaining holes 47a and 48a holding the retainers 15U and 15D of the circumferential wall portion 14 from breaking if subjected to a strong tensile force when the doors 52 open. Of course, since the remaining regions of the two-color part 56 such as the general section 45 of the airbag cover 44 apart from the doors 52 and the box body 61 belong to the hard section 58 having rigidity, the two-color part 56 is capable of keeping a predetermined shape easily.

[0059]

Besides, in the embodiment, the lid 73 of the container box 60

is swingably supported by the pivot sections 28 formed in the case 12 of the airbag device 11 so it opens and closes the opening 61a of the box body 61. That is, since the case 12 is made of rigid sheet metal and secured to the vehicle body 1 tightly so as to allow the inflating airbag protrude from the opening smoothly, the lid 73 supported by the pivot sections 28 formed in the case 12 opens and closes in a stable manner.

[0060]

Without considering above effect, it will also be appreciated to form the pivot sections in the box body 61 to support the hinge arms 74 of the lid 73 for opening and closing the opening 61a.

[0061]

In the occupant protection device S of the embodiment, the knee-protecting airbag device 11 and the container box 60 are assembled in advance to form the mounting module 10. The knee-protecting airbag device 11 and the container box 60 are mounted on the vehicle at one time by mounting the module 10 on the vehicle. This arrangement conduces to work improvement, and reduce a tact time per vehicle, compared with a case of mounting the knee-protecting airbag device 11 and the container box 60 separately.

[0062]

Of course, without considering the above effect, the airbag device 11 and the container box 60 are mounted on the vehicle separately.

[0063]

In the foregoing embodiment, moreover, the box body 61 is abutted on and supported at its lower surface 64a of the lower wall 64 by the support sections 20 and 21 protruded upward from the case 12. Here, since the case 12 is made of rigid sheet metal, and is secured to the

vehicle body 1 tightly so that the inflating airbag 39 may smoothly protrude from the opening 13a, the lower wall lower surface 64a of the box body 61 is securely supported by the support sections 20 and 21. Accordingly, even if heavy objects are housed in the box body 61, the box body 61 is prevented from deforming, and thus is able to keep good appearance. Especially, since the support sections 20 and 21 support the lower surface 64a of the lower wall 64 in the box body 61 widely in the transverse direction at the front edge 64c side and the rear edge 64d side, the box body 61 is stably supported.

[Brief Description of the Drawings]

Fig. 1 is a front view of an occupant protection device embodying the present invention as mounted on the vehicle, as viewed from rearward of the vehicle;

Fig. 2 is a schematic vertical section of the occupant protection device of the embodiment as mounted on the vehicle, taken along the front-rear direction of the vehicle;

Fig. 3 is a schematic enlarged vertical section of the occupant protection device of the embodiment as mounted on the vehicle, taken along the front-rear direction of the vehicle;

Fig. 4 is a schematic front view of a mounting module in the occupant protection device of the embodiment;

Fig. 5 is a schematic enlarged vertical section of a knee-protecting airbag device of the embodiment;

Fig. 6 is a schematic enlarged cross section of the knee-protecting airbag device of the embodiment;

Fig. 7 is a schematic cross section of a container box of the embodiment, taken along the line VII-VII of Fig. 4;

Fig. 8 is a schematic vertical section showing the joined condition

of the knee-protecting airbag device of the embodiment and the vehicle body, taken along line VIII-VIII in Fig. 4;

Fig. 9 is a schematic vertical section showing the way a lid of the container box in the embodiment is supported, taken along line IX-IX in Fig. 4;

Fig. 10 is an exploded perspective view of the container box and the case of knee-protecting airbag device in the mounting module of the embodiment;

Fig. 11 is a perspective view of a two-color molded part of the embodiment; and

Fig. 12 illustrates a mounting work of the airbag cover of the embodiment on a case.

[Description of the Reference Numerals]

- 11 ... knee-protecting airbag device
- 12 ... case
- 13a ... opening
- 14 ... circumferential wall portion
- 15 (15U, 15D) ... retainer
- 28 ... pivot section
- 31 ... inflator
- 39 ... airbag
- 44 ... airbag cover
- 47, 48 ... joint wall
- 47a, 48a ... retaining hole
- 51 ... breakable portion
- 52 (52U, 52D) ... door
- 53 ... hinge line
- 56 ... two-color molded part



57 ... soft section

58 ... hard section

60 ... container box

61 ... box body

61a ... opening

73 ... lid

M ... vehicle occupant

K (KL, KR) ... knee

S ... occupant protection device



Fig. 1

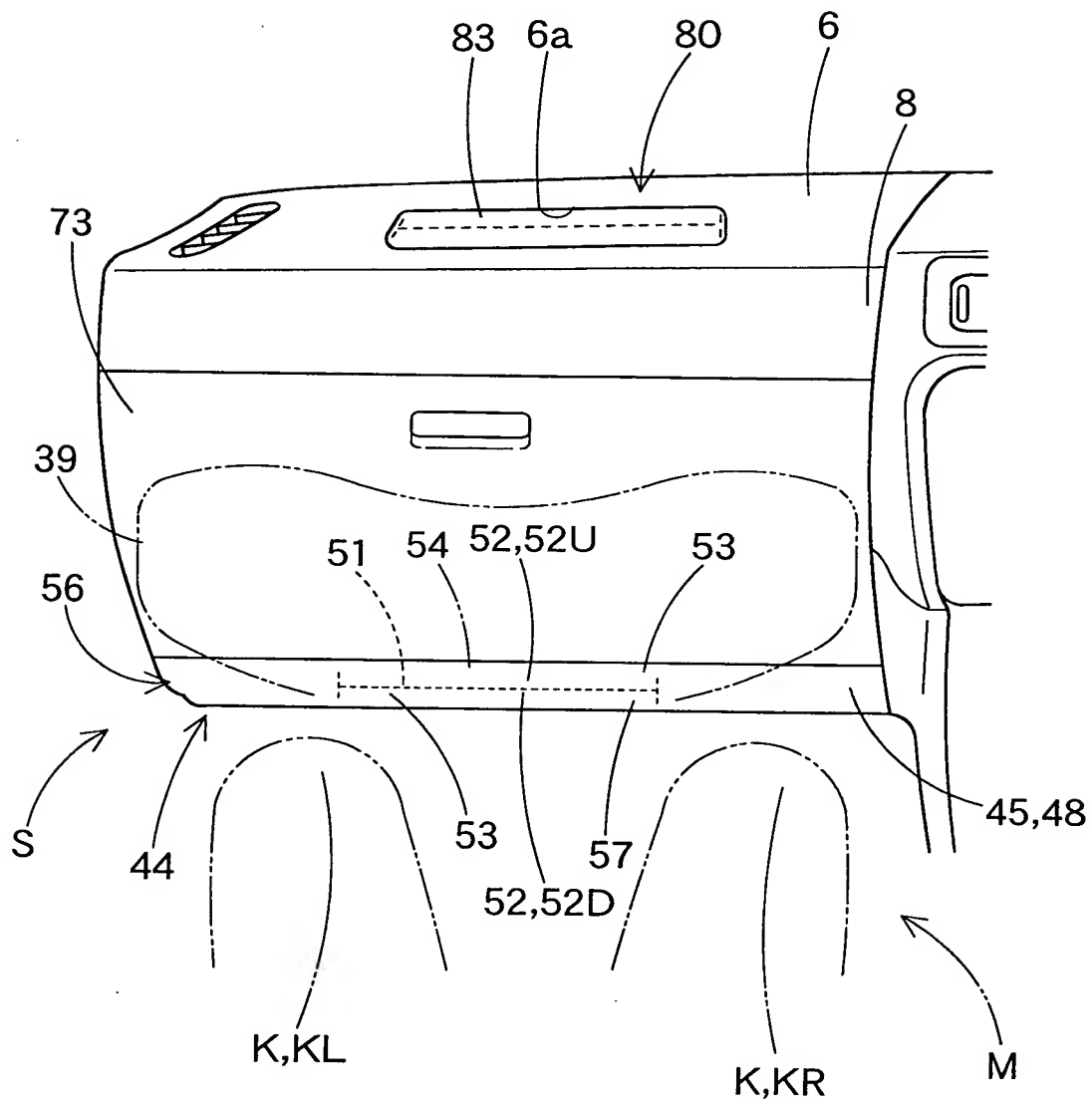
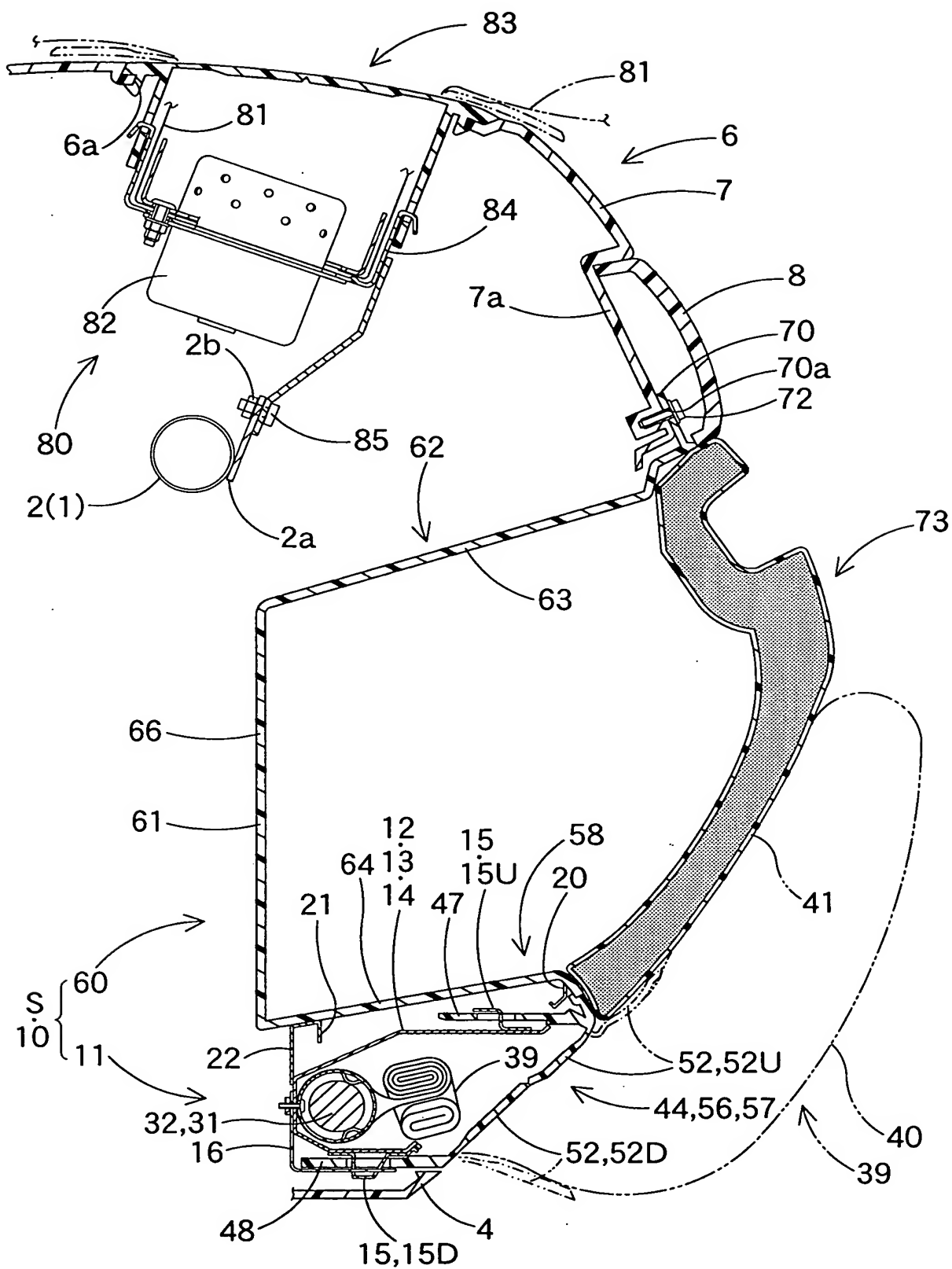
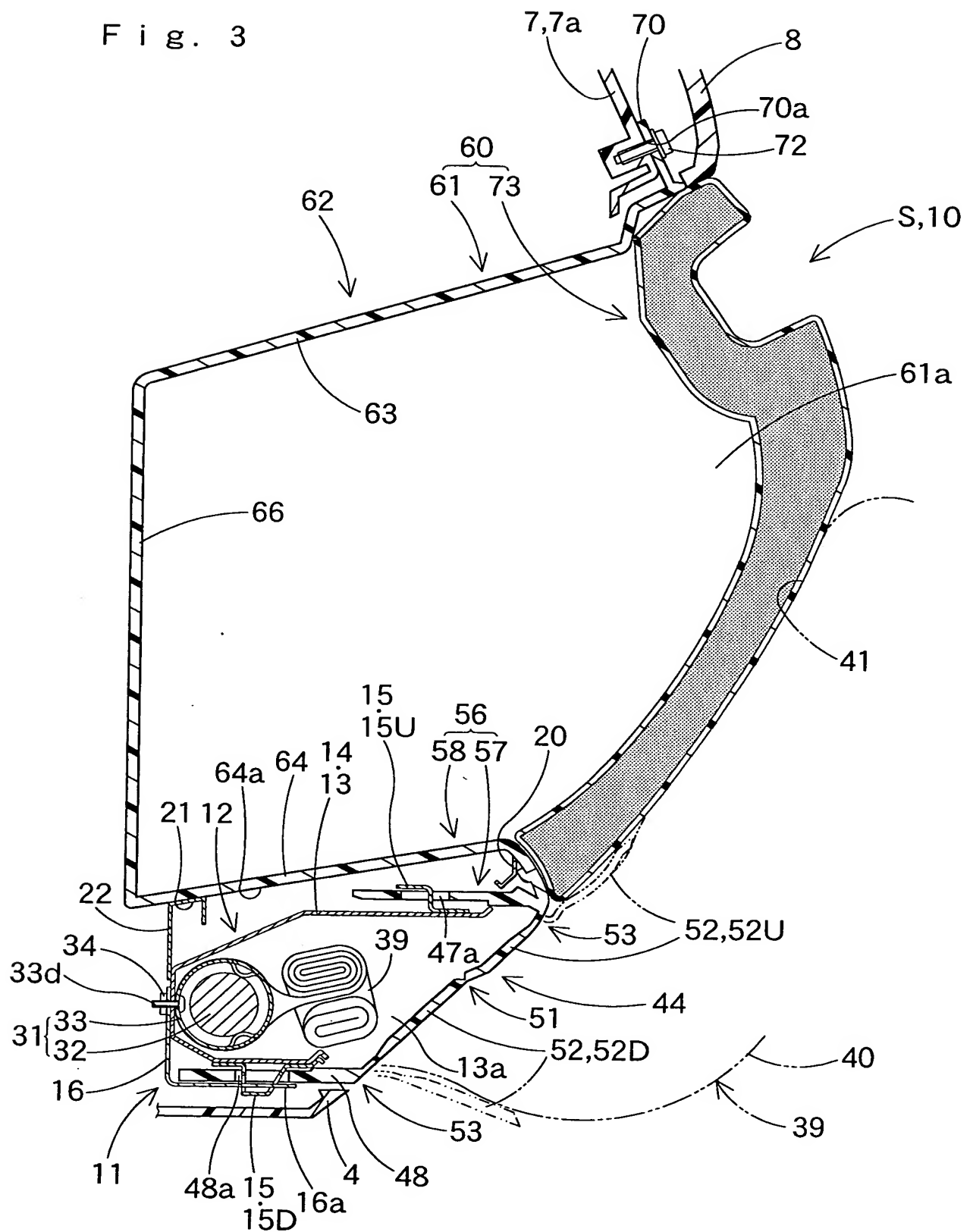


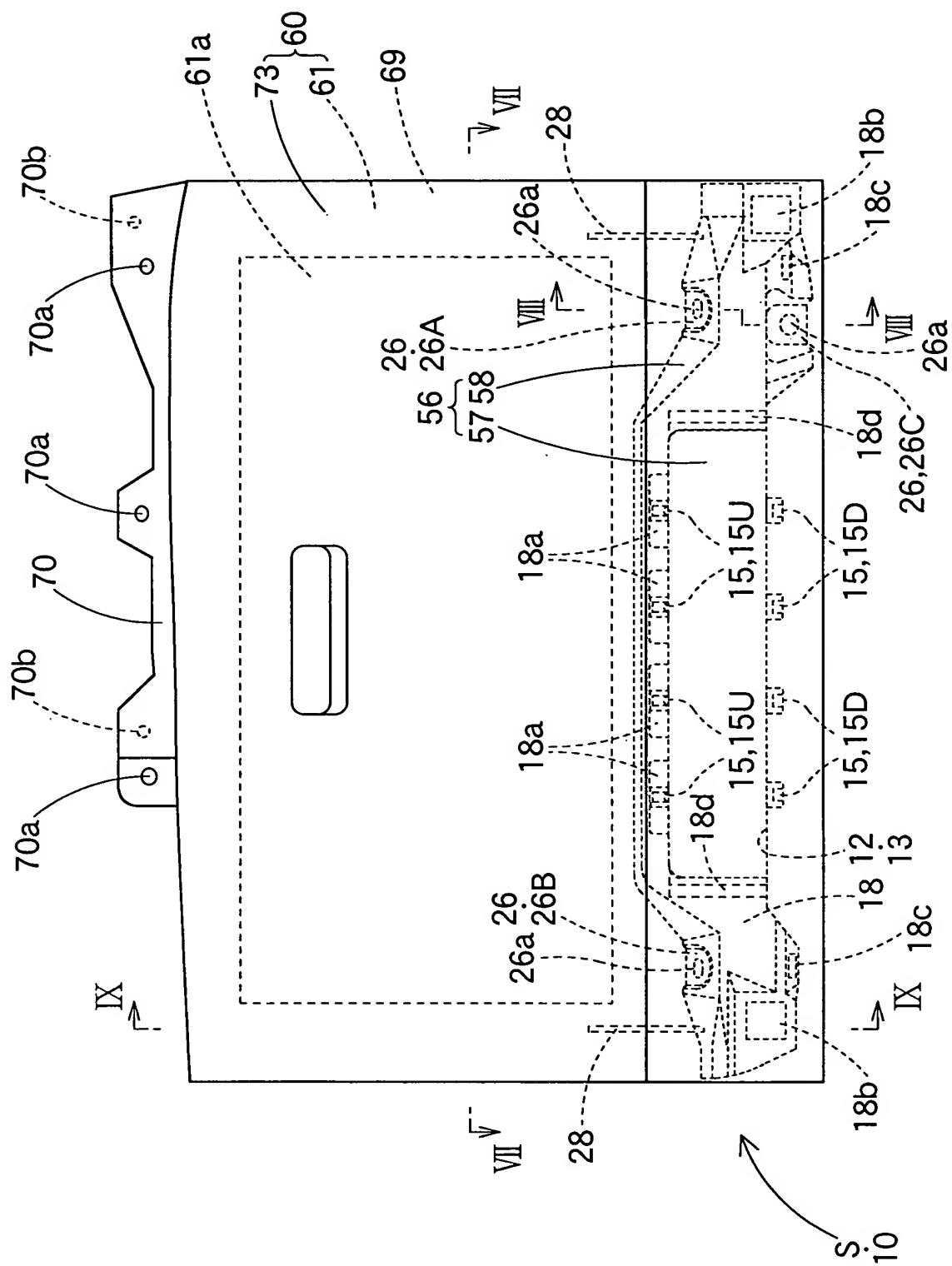
Fig. 2



F i g . 3



F i g . 4



F i g . 6

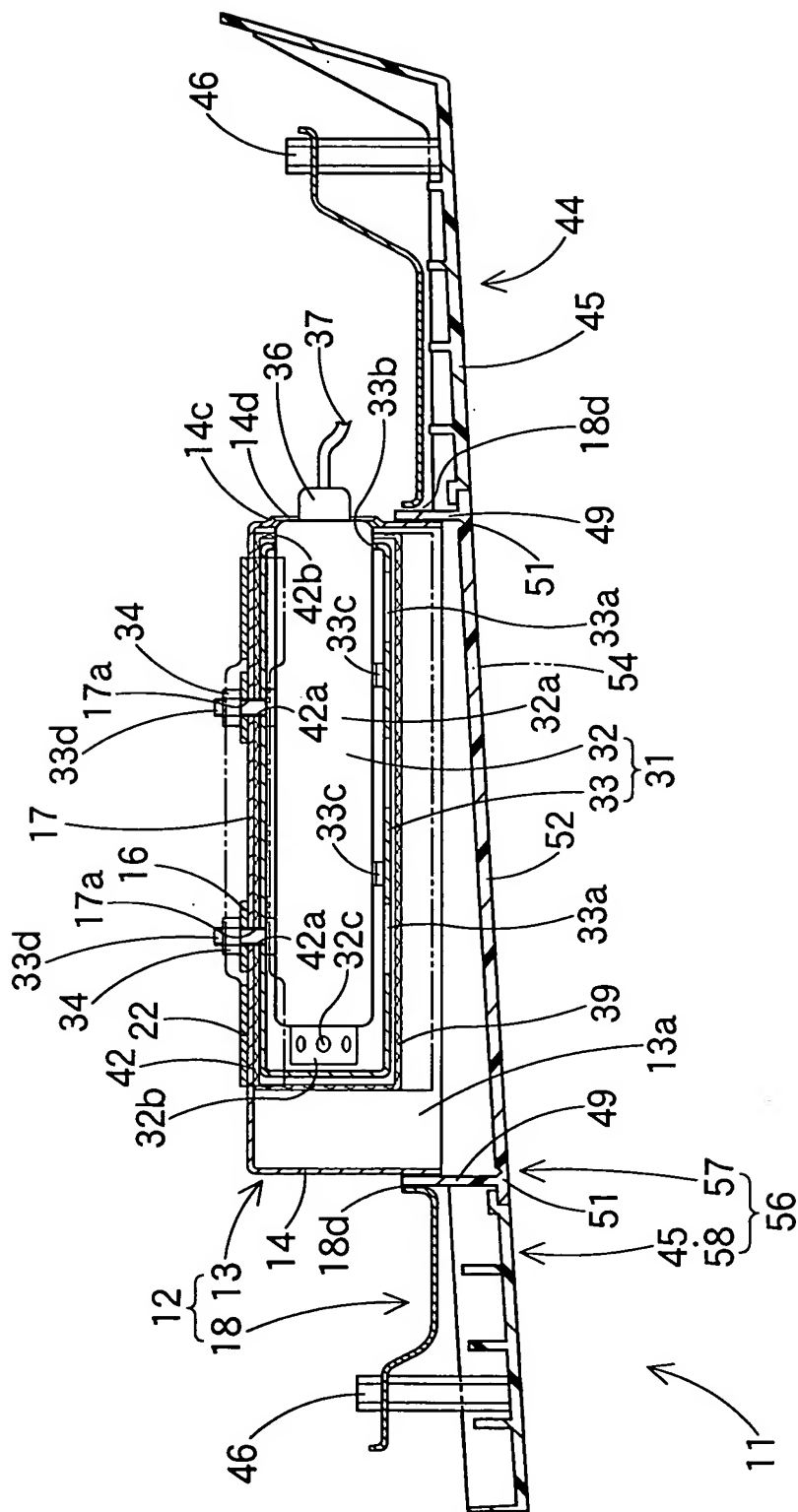
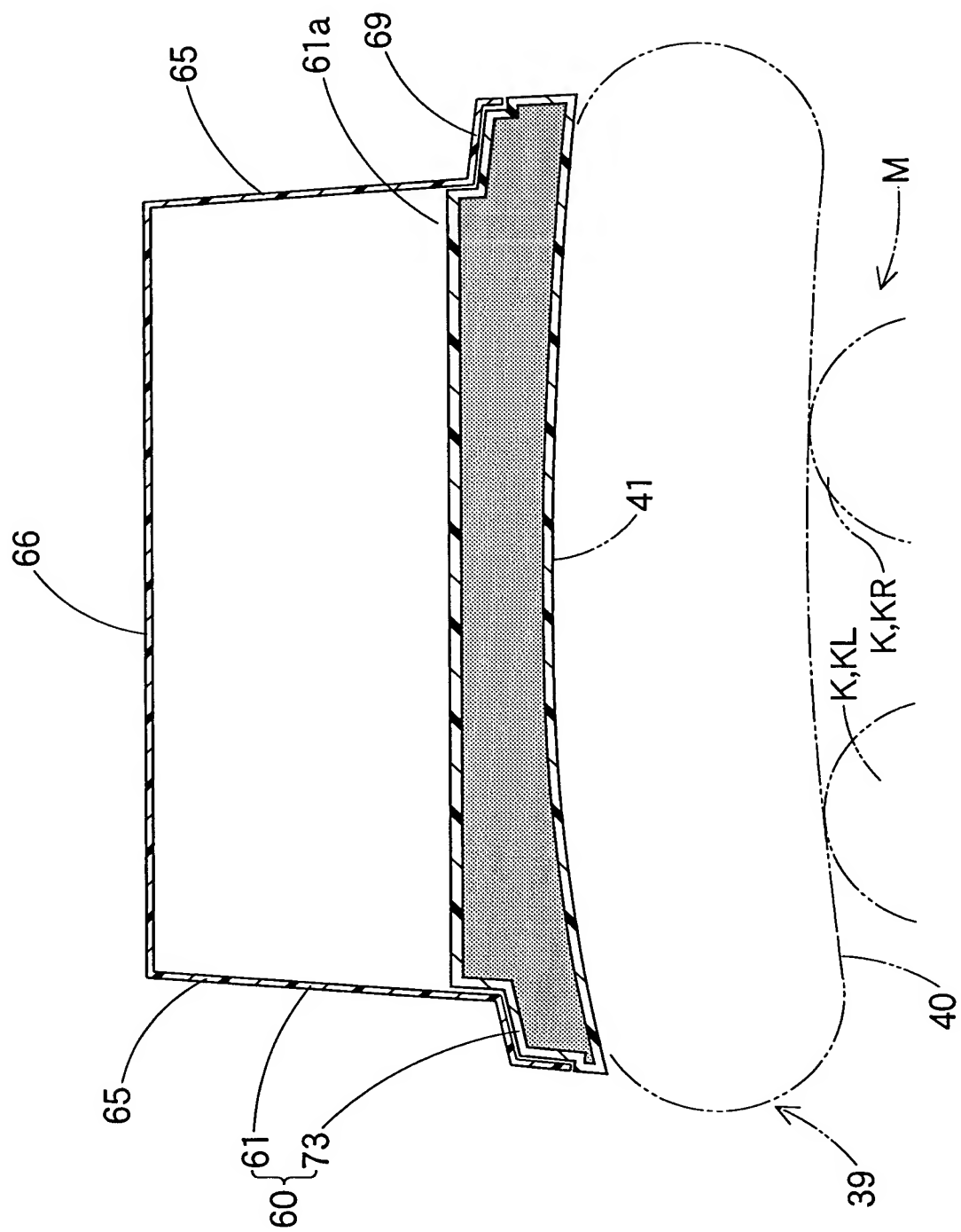


Fig. 7



F i g . 8

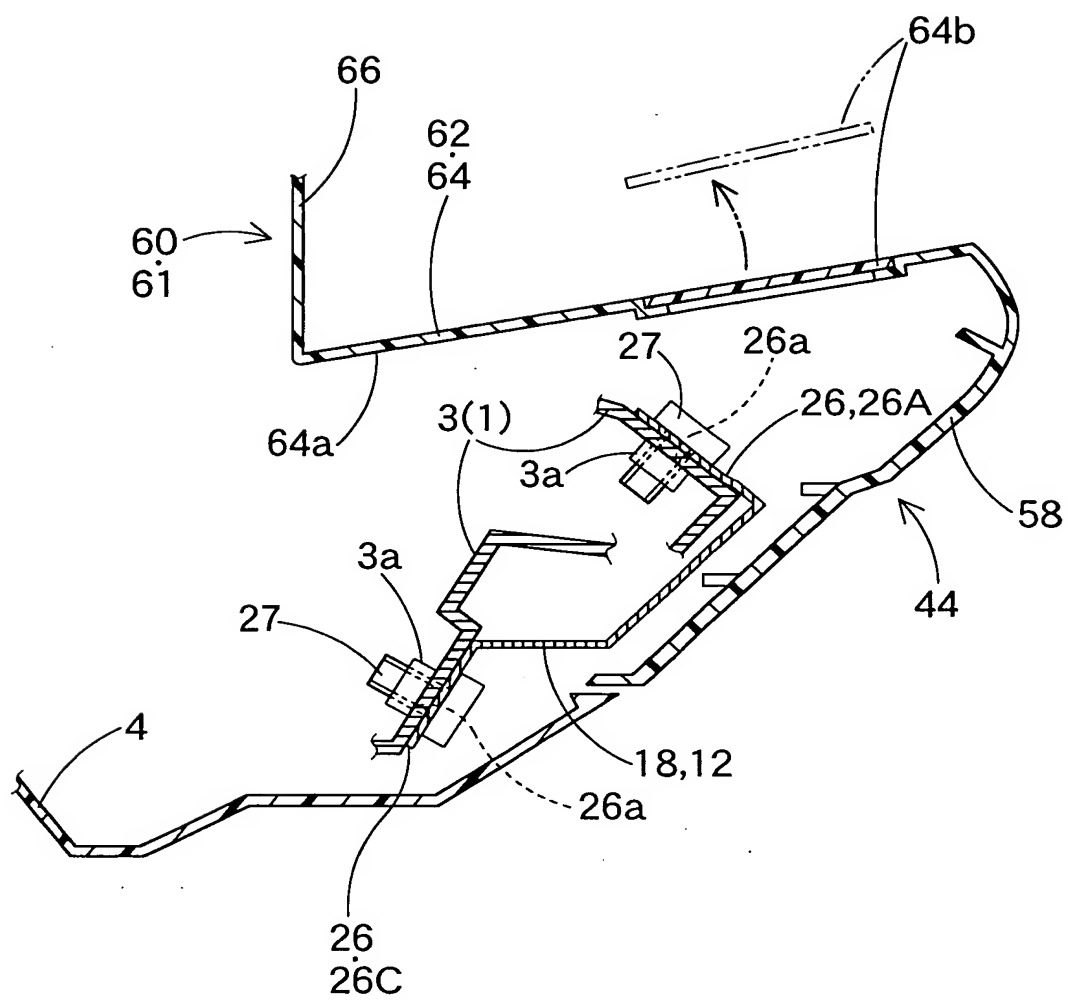


Fig. 9

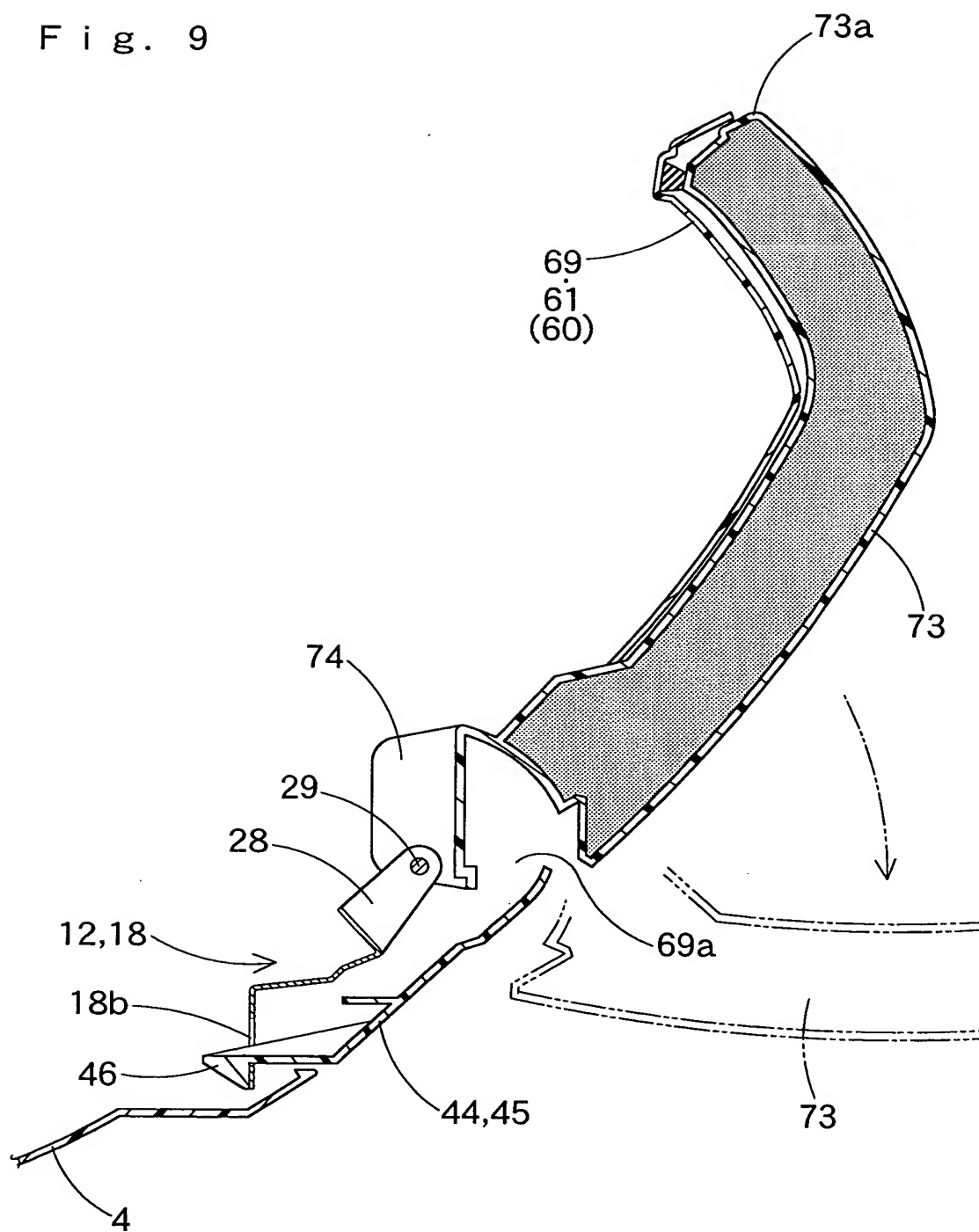
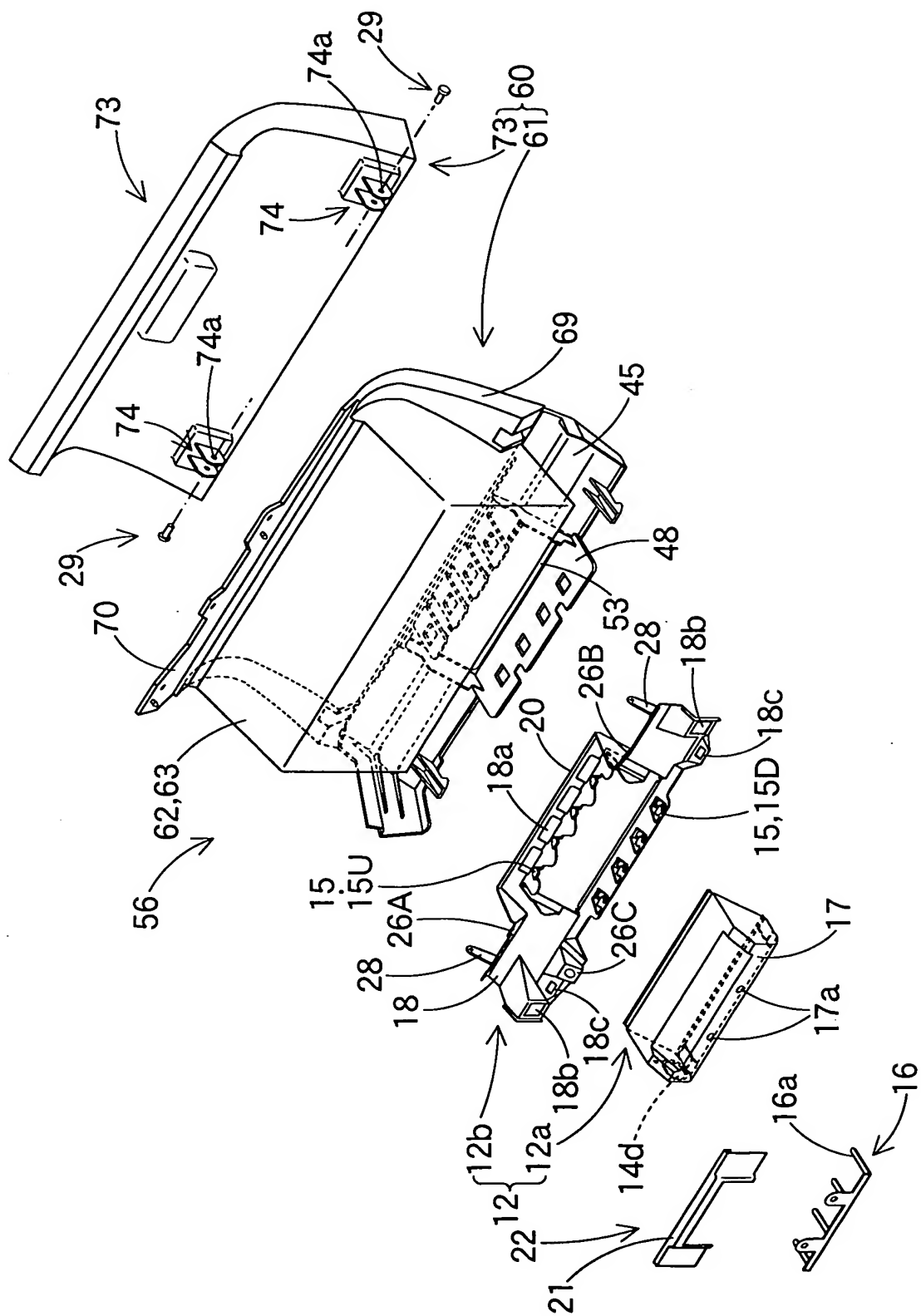


Fig. 10



F i g . 1 1

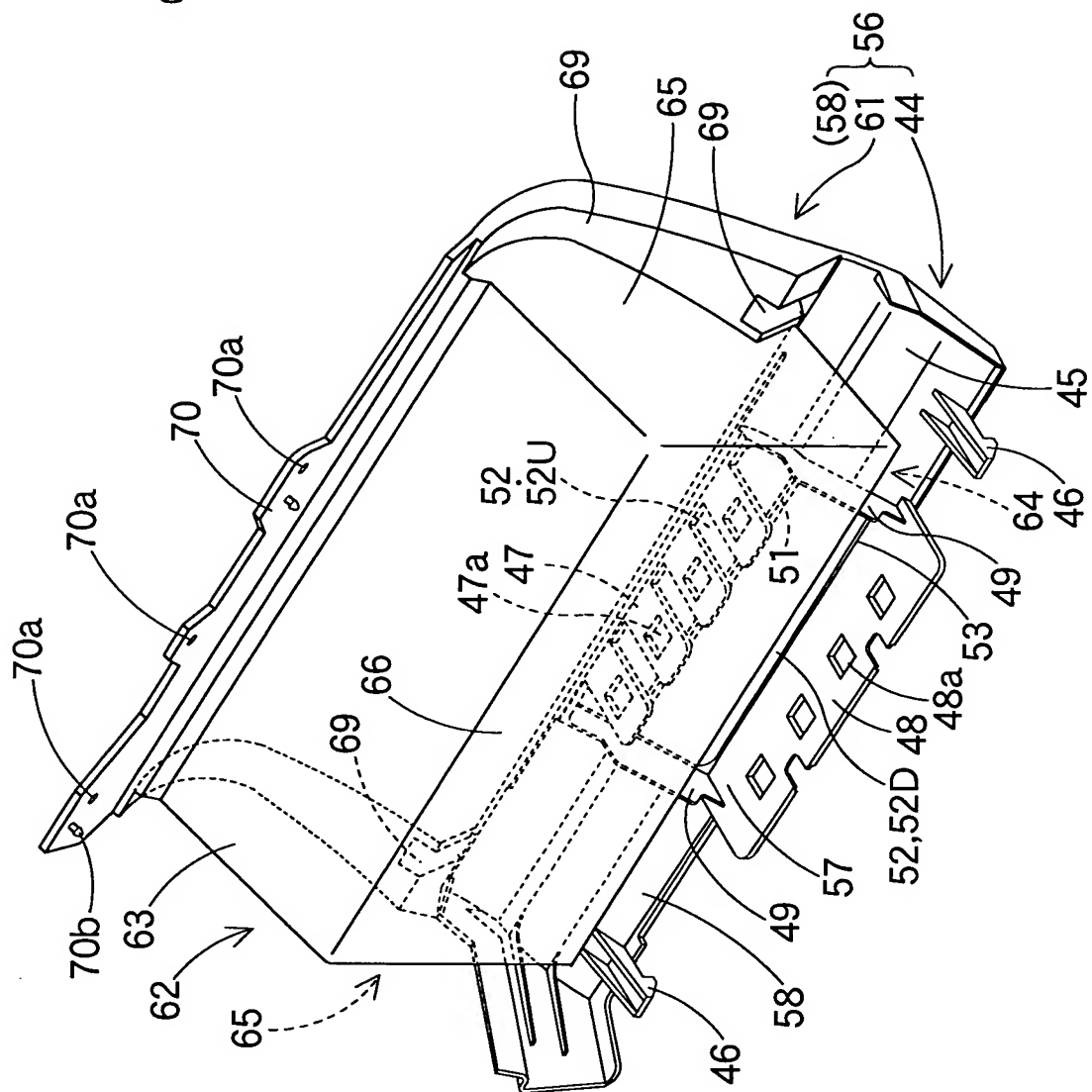
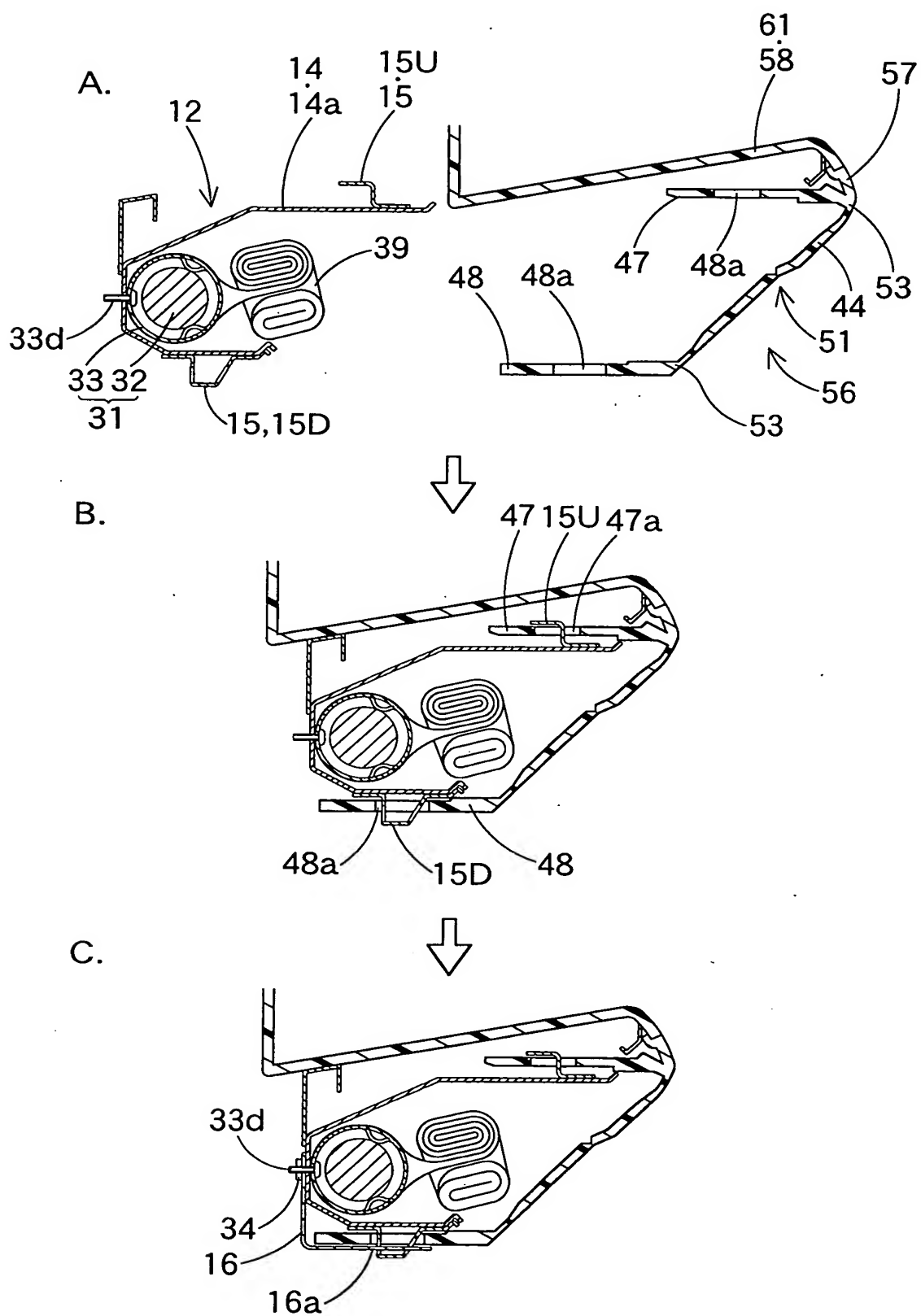


Fig. 12



[Name of the Document]

Abstract of the Disclosure

[Abstract]

[Task] To provide an occupant protection device which reduces the number of components and improves the mounting work even if a container box and a knee-protecting airbag device for protecting knees of an occupant seated in a front passenger's seat are both mounted in front of the front passenger's seat.

[Means of Solving the Problem]

The occupant protection device S includes a knee-protecting airbag device 11 for protecting knees of a vehicle occupant in the event of collision of a vehicle, and a container box 60 for housing goods. The airbag device 11 has an airbag 39, an inflator 31, a case 12 for housing the airbag 39 and the inflator 31, and an airbag cover 44 for covering an opening 13a of the case 12 and openably attached to the case 12. The container box 60 includes a box body 61 and a lid 73 covering an opening 61a of the box body 61 in an openable manner. The box body 61 and the airbag cover 44 are molded into a single-piece molded part 56 of synthetic resin.

[Selected Drawing]

Fig. 3